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BRANCH OF RESEARCH
MONTHLY REPORT

May, 1935

BRANCH OF RESEARCH

May, 1935

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CALIFORNIA FOREST EXPERIMENT STATION

Forest Management - Pine Region

The long awaited year of plenty may be here - relative to tree seedlings in the Sierra Nevada. Since 1910 quadrats and other devices have been hopefully examined to determine what happens to natural reproduction and why. But there have been few seedlings to study and even more or less artful priming of Nature's machinery has been ineffective.

A good seed crop last fall and a generous winter have started seedlings "like grass" at Stanislaus Branch. Of course they are nearly all fir and cedar. There are strong indications that, where site factors permit entry of all species, mice may control composition appreciably. Unscreened areas show little damage to fir and cedar but nearly complete elimination of sugar and ponderosa pines.

But there is always a "ketch to it." If funds are withheld much longer the subjects may die without benefit of professional services.

Close observation of flowering and fruiting in the tops of forest trees is fraught with practical difficulties. At Stanislaus Branch ladders are being built into the crowns of bearing trees to permit regular observations and placement of instruments.

Standard soil beds are being constructed at Stanislaus Branch by Chandler and Partington with the aid of the CCC to permit study of root behavior of normal and wounded (pruned) seedlings.

Forest Management - Redwood Region

During the past month all but one of the 12 men working on redwood studies have been transferred from the analysis of the yarding data collected from redwood logging operations last summer to the experimental logging and milling operation being carried on by the Dolbeer-Carson Lumber Company in cooperation with the Experiment Station and the Division of Management of the Regional Office.

This project includes a complete experimental tractor logging operation to be followed by a mill study of the logs from 100 selected trees. The area involved includes 80 acres of redwood forest typical of the better stands of the northern part of the redwood region.

It is located on Henry Creek, a tributary of Elk River in Humboldt County. Preliminary work, including detailed mapping and cruising of the area was completed last fall. Mr. Berry prepared a logging plan, located the tractor roads and selected the trees to be cut. The management-redwood studies now in progress include time studies on falling, bucking, peeling, yarding, and loading. Detailed tree measurements, which will be used later in the preparation of a redwood volume table, are being taken and logs are being graded, before being peeled, according to standards developed by Brundage and Berry.

The operation is particularly interesting because it marks the extension of tractor logging into the heavy redwood type where the ground is rough and many of the slopes steep. The latest 80 hp. diesel tractors, with double and single drums, arches, and bulldozer are being used.

Forestation

Seeds

Determination of the germinative capacity of seeds by staining has been tried with several coniferous species. The method used is based on the fact that living tissues do not absorb certain acid dyes dissolved in water, whereas dead cells absorb them readily. In our tests the outer seed coats were removed and the seeds soaked in water over night. The embryos were then taken out and stained in a 1:2000 solution of indigo carmine for two hours, after which they were rinsed in water and the degree of staining observed. One hundred seeds were used in each test. The following table gives the results:

Comparison of Germinability of 100 Seeds by Various Tests

Number	Species	Cutting test May 1935 Number of apparently good embryos	Germination test April 1935 Number germinated	Staining test, May 1934		
				Stained	Empty	Not stained
2470	Pinus sabiniana, 1934 crop	90	84	0	10	90
	Same. Embryos killed by boiling	-	-	90	10	0
429	P. lambertiana, 1928 crop; stored at 40°F.	97	28	68	3	29
2467	P. ponderosa, 1933 crop	100	89	9	0	91
432	P. ponderosa, 1928 crop; seed treated in 1929 with 1% formaldehyde solution for 6 hrs. and air dried for 24 hrs.	100	0	100	0	0
430	P. jeffreyi	72	30	30	28	42
428	Abies concolor	All embryos shrunk	0	100	0	0

The method appears to be valuable for quick determination of the germinative capacity of seeds.

Range Research

Additions to the Staff

Jesse W. Nelson, for the past fifteen years in charge of the Division of Range Management of the California Region, has been assigned to the Station as a Senior Range Examiner. His new duties will include supervision of the San Joaquin Experimental Range, the study of grazing problems involving dependency surveys, cooperation with University of California officials, stock associations, and stockmen on range problems and extension work with range users and National Forest permittees.

Robert W. Gardner and T. W. Daniel from the University of California, and Arnold E. Schulze from the University of Chicago, have been assigned as Junior Range Examiners to assist with the foothill range studies at the San Joaquin Experimental Range.

San Joaquin Experimental Range

The Station's "rattlesnake ranch" (over 200 killed to date this season) is soon to become a full fledged cow ranch as the interior fences and cattle guards at the San Joaquin Range are completed.

At the present time Dr. George H. Hart, of the Animal Husbandry Division, University of California, is accompanying Jesse W. Nelson on a trip to purchase stock to be run on the Experimental Range.

Intensive work in pastures where annual types of vegetation predominate has brought out the need for the development of experimental methods designed to meet more nearly the particular conditions encountered. With this in mind, Klugh and Biswell have been studying vegetation at the San Joaquin Experimental Range, the objective being to determine the number, size, and shape of small sample plots necessary to sample adequately an experimental pasture. Klugh has spent some time applying the Australian point method of measuring vegetation.

Clark Area

At the Clark Area, on the North Fork to O'Neal road, Biswell and Daniel recently completed "repeat" sampling of the vegetation. Here, for the past few years, vegetation has been studied under grazed and ungrazed conditions, as well as within rodent exclosures.

Erosion-Streamflow

San Dimas Experimental Forest

Flume Experiment. A series of test runs was made on May 23. This experiment included tests of a further modification of the parallel-walled flume previously used. The newest flume, designed on the basis of theoretical computations, is trapezoidal in cross-section, with a conical intake, but otherwise similar in plan to the previous model. The purpose was to give greater sensitivity and capacity, and to reduce the hydraulic drop at high stages, so as to bring the line of critical depths closer to vertical. Authorities consulted gave their opinion decidedly in favor of this design.

Vegetative Survey. Statistical methods of analysis have been applied to the plot data from the vegetation survey of the Bell Canyon Triplicate Watersheds. As yet no definite conclusions have been reached except that the type map is accurate within five per cent. The herbarium at Tanbark at present contains about 150 species from the San Dimas Experimental Forest.

Fire Prevention. At the Angeles National Forest Fire Guard School at the Tujunga CCC Camp on May 29, Garstka presented a method of demonstrating the action of forest fire travel and spread by means of a plaster relief model. A mixture of wood flour and potassium chlorate which was spread over the model, when ignited showed the varying rates of fire spread up and down hill.

North Fork Runoff and Erosion Plots

The fifth annual examination of vegetation on the North Fork runoff and erosion plots has disclosed some interesting trends on the three pairs of plots, two of which have undergone manipulation of the vegetation. One pair of plots on which the cover has not been disturbed has shown in the short period of five years a decrease in the density of cover produced by suffrutescent shrubs, while the ground cover afforded by herbaceous species and grasses has increased slightly. The decrease of shrub cover has been due largely to the gradual dying out of Ceanothus cuneatus which will no doubt be replaced by Aesculus californica and Quercus wislizenii; seedlings of these two species have increased noticeably in the past two years and constitute the slight increase in ground cover.

Two of the plots that are denuded annually show a slight decrease in ground cover, and a decided decrease in litter cover. The herbaceous cover of annuals is gradually being supplanted by Bromus rigidus, B. rubens, and Festuca megalura.

The pair of plots that were denuded 3 years ago are recovering rapidly. The increase of shrubs from sprouts and by seedlings is noticeable each year. Shrub cover, ground cover and litter have all increased perceptibly during the past three years.

One item that is worthy of mention is the remarkable tree reproduction that has occurred on the new Bass Lake plots, due undoubtedly to a good seed crop year and favorable moisture conditions. On the six plots examined an average of 1000 ponderosa pine seedlings per plot were found. It will be of interest to watch the survival and development of pine reproduction on these plots in conjunction with the runoff and erosion studies.

Forest Survey - Cover Type Map

The end of May has brought the area mapped since January 1 up to the total of approximately 1,240,000 acres, principally in southern California. In addition, an area of about 775,000 acres, extensively mapped during the early history of the project, has been checked and brought up in line with present standards. Meanwhile, the accumulated office work of past field seasons has practically been completed.

At the present time ten 2-man crews are in the field, with the work for the summer season being directed towards completion of the vegetation type mapping necessary for the forthcoming land use studies in the south central Sierra (Amador, Calaveras, Tuolumne, Mariposa, Madera) counties and the Santa Cruz Mountains - Salinas Valley counties (San Mateo, Santa Cruz, Santa Clara, San Benito, Monterey, San Luis Obispo).

Forest Economics

Land Use Planning

Hill and Wieslander participated with Land Planning representatives of the Regional Office in round-up trips to start the reports on Forest-Farm project areas required by the Forester. These trips also had the benefit of advisory participation by Prof. David Weeks, of the University of California, and AAA Land Planning Consultant for California.

One of the most striking impressions of this round-robin trip to the forests was the amount of thinking which the Supervisors had been giving to land use problems, the competence of their thought and their preparedness and readiness to "go" on this difficult program. Perhaps the second most striking thing was the clear superiority, for such a purpose, of a natural planning unit such as these National Forest projects premise, as the basis of thinking rather than the "problem area" basis of the National Resources Board set-up. The planning unit must of course include, or have direct reference to, the problem area, or, at the other end, the resettlement area; but it is not clear that the NRB or AAA have realized sufficiently the difference between the point of view sufficient for recognizing the sore spots and that required for trying to do something constructive about it.

As one example, in the Scott Valley the project of that name on the Klamath Forest has an area of several thousand acres of exceptionally fine farm land. The farmers are fairly prosperous, in spite of depression, actual distress is practically absent and relief is negligible; but the farms could carry much larger herds

than they do, if more mountain range were available. The range exists but the government does not own it, and it is not available to these local residents.

One fine farm, which is in financial distress offers the possibility of individual relief by government purchase, and is strategically located for the location of subsistence farmsteads for resettlement from more distant distress areas demanding population transfer, to operate in conjunction with possible industrial developments.

Such a possibility cries for recognition in connection with the timber of the surrounding mountains, which comprise a potential sustained yield working circle sufficient to support a considerable sawmill and dependent community in the valley. The fly in the present ointment is, again, that the government owns too little of this timber to permit any effective control, and the private timber owners know or care for nothing beyond the traditional skin-and-get-out. The project must, therefore, include federal acquisition of large proportions, in both timber and range land. But the future picture, on the one hand of a community, while not distressed, stagnant because of lack of mountain range and lacking balancing sources of income, and on the other of added resources permitting increased population and prosperity, stabilized by diverse resources, is such as to fire the imagination to help bring the latter to pass. The key to the whole is the recognition, as a part of the project, of the large mountain areas necessary to maintain permanent timber industry and grazing use.

Taxation Studies

The tax report covering the foothill counties of the eastern side of the Sacramento Valley has been written and is now being reviewed. This report reveals the extent to which property tax administration departs from the legal requirements; the wastefulness of the method of apportionment of school funds by the State; the great extent to which the tax burden has been shifted from property to other sources during the past four years; and the relatively small extent to which the tax base of these counties is composed of the unimproved real estate in the foothill and watershed districts.

For the first time (perhaps first in the history of the State) a table has been prepared showing by counties the acreage of property which remains in State ownership through forfeiture, and this property has been located on maps.

The report brings out strikingly, to the forester, that sound appreciation of the relative tax burden on forest and other property, of land use as a factor in public finance, or even of federal

contributions (such as 25% fund, etc.) in lieu of taxation is impossible, and policies of readjustment are largely futile, in advance of thorough reform of the operation and administration of the property tax. It is for this reason that the report makes suggestions in this direction. Among such is the possibility of bringing the local government into harmony with the environment of a forest region. The unorganized territory of northern Maine is mentioned as an example of local government organization which is suitable to the environment of the Sierra Nevada region. Other recommendations in this direction concern full value assessment of all taxable property, improved tax collection procedure, the administration of tax forfeited lands, and reorganization of local government in the interest of economy and efficiency.

The taxation studies in the foothills of the Sierra Nevada have revealed some results of the apportionment of 25% of national forest receipts to counties which could not have been forseen when that legislation was enacted. In many cases, mainly due to State subventions, schools and roads (outside of national forest roads and trails) are supported entirely by taxes other than property taxes, derived from the State as a whole; and thus national forest contributions to such counties for schools and roads can no longer be said to be in lieu of property taxes for these purposes. A large part of the contribution from national forest receipts to Mariposa County goes to the support of the school district comprising Yosemite National Park. This can hardly be said to be in lieu of taxes on national forest lands in that district. Another school district (containing head-quarters of a national forest) levies no taxes for school purposes, yet receives such large school funds that it is able, besides paying all costs of a rather large and complete school, to put in the bank several thousand dollars a year in a fund to provide for construction of new facilities, as desired, without either taxation or bonding by the district itself. This district is one of those which benefit unduly from an inequitable distribution of State school funds, aided by Indian Service payments which amount to 40% of its whole school budget, on account of the large Indian school population in that district.

CENTRAL STATES FOREST EXPERIMENT STATION

General

Field Inspection Trip. Members of four of the eastern Stations held an inspection trip through portions of the Appalachian, Southern, and Central States regions during the last two weeks in May. The party met in Knoxville, Tennessee on May 14 and spent the day with members of the T. V. A. forestry staff looking over projects in the vicinity of Norris Dam. Several days were spent in North Carolina and north Georgia inspecting experimental forest developments, streamflow and management projects in the Appalachian territory. From there the trip extended south to Macon, where the meeting of the Georgia Forestry Association was in session, and to the Lake City Branch of the Southern Station in Florida; west through the Florida National Forest units to New Orleans, where a day was spent at the Southern Station; north to Bogolusa and through Mississippi to Holly Springs; west into Arkansas through the Ouachita and Ozark National Forests. The trip ended at the Sylamore Experimental Forest on May 28.

Demmon, Harper, and Baker made the entire trip. Behre and Westveld of the Northeastern Station accompanied the party through the Appalachian region as did Frothingham, Hursh, and other members of the Appalachian Station. Forsling went as far as Lake City, Florida. Assistant Regional Forester Shaw left the group in North Carolina and joined it again at Holly Springs for the balance of the trip. George Duthie of the Washington office joined the party at Tallahassee and continued with it to Holly Springs, where Regional Forester Kircher was contacted for a day. Forest Supervisors and members of their staffs accompanied the group through their forests locally throughout the trip. Meginnis made the trip through Arkansas, and Day joined the party at Sylamore. After the group broke up, he and Baker made plans for further development of the Sylamore and Shawnee areas on route to Columbus. The trip was most interesting and worth while, and pointed out the need for men in research to make more contacts and to keep in touch with developments outside of their own regions.

Branch Stations. Edwin R. Warner, Technician at the Hicks C.C.C. camp in southern Illinois has been detailed by Supervisor Knutson to direct the activities of a permanent crew of 25 men assigned to development and improvement work on the Shawnee Experimental Forest. This cooperation will result not only in greatly increased development of the area for research use, but also in closer coordination between research and administrative activities.

Ash for the Laboratory. M. Y. Pillow of the Forest Products Laboratory visited the Station in an effort to locate second-growth ash suitable for certain laboratory tests. Kellogg assisted him while he was in this vicinity.

Sycamore Blight. A recurrence of the Sycamore blight (Gnomonai venata) has been noted this spring on a great many sycamores all over Ohio and northern Indiana. Twigs in all portions of the crown are attacked and killed, leaving the trees in a partly defoliated condition. The last severe attack in this vicinity was noted in 1931.

Forest Management

Reproduction Studies. On the Shawnee Experimental forest in Illinois, Sutton has established a series of mil-acre quadrats, extending into abandoned fields north and east of the headquarters, to determine the character and composition of the natural regeneration and the rapidity of its establishment. Growth and yield plots are also being established in hardwood stands on the area.

Kuenzel has prepared a progress report based on five years' records on the growth and mortality of chestnut oak seedlings in southern Indiana. This work was initiated by L. I. Barrett in 1928. The report: "The Influence of the Degree of Cutting on the Survival and Early Growth of Chestnut Oak Seedlings," has been mimeographed as Station Note #23.

Data bearing on a study of red oak reproduction in farmwoods previously pastured and the effect of grazing on site factors pertinent to seedling survival, have been compiled by O.D. Diller into a short paper. This report: "The Effect of Woodland Grazing on Certain Site Factors in the Oak-Hickory Type," has been issued as Station Note #24.

Indiana Sustained Yield Demonstration. Kuenzel spent additional time in Dubois County, Indiana, during May, collecting field data for determining the amount of defect and cull per cent for the species encountered by the survey crews. Data were assembled from woods operations, portable sawmill operations, and estimates of competent operators and wood buyers in the county. The tabulation of sound and defective volume of 100 trees cut and measured on two local logging operations is being compiled by species and forest types.

Dean Skinner, Director of the Purdue Agricultural Experiment Station, has shown a very keen interest in the project and is taking steps to secure approval of the appointment of an Extension Forester who will be definitely assigned to the project to carry out the provisions of the management plan. Director Skinner also has indicated

his desire to publish a preliminary report covering the cooperative project, and especially its objectives and the proposals for carrying out these objectives.

Damage by Selective Logging. While Kuenzel was collecting data to determine defect and cull per cent for the timber in Dubois County, Indiana, the cumulative damage to hardwood stands caused by selective cutting was noticed in several instances. He observed that there is an ever increasing amount of defective material produced by these stands after successive logging operations. This accumulation of defect has been attributed usually to the selection and removal of sounder trees and to the leaving of defective ones; but Kuenzel's observations point also to the damage to young growing stock which should be the crop trees of tomorrow, many of which become defective from the damage caused in cutting. In an oak-hickory stand, a 24-inch tree, removed 10 years ago, stripped bark from a 12-inch walnut, broke off an 8-inch mulberry, scarred 2 hickories 5" and 6" in diameter and two hard maples 6" and 8" d.b.h. Decay had entered at four broken branch stubs 12 feet, 10 feet, 20 feet, and 20 feet in height, respectively.

Another cutting in 1935 in the same stand removed two 28" white oaks and an 18" red oak. Damage, ranging from breaking off of trees to stripping of branches, occurred to five shagbark hickories, one white oak, three hard maples, and one elm. This logging was done by the owner as carefully as possible, and does not represent an extreme case. The selective cutting of large hardwoods in all-aged stands without damaging the smaller trees severely presents a distinct problem.

Cutting to Remove Hop-hornbeam. Diller spent three days in Grant, Cass, and Dekalb counties, Indiana, making remeasurements of a cutting experiment in which a method of removing hop-hornbeam (Ostrya) was sought. Hornbeam frequently seeds in on grazed and thinned woodlands to the exclusion of more valuable species. The saplings on these plots were cut at various stump heights, ranging from the ground surface to 48 inches high. Trees were cut during August and September, 1933, and in July, 1934. Observations of the plots showed that the hornbeams had sprouted only from the main stems and not from the roots. This is apparently the reason why the trees cut at the ground surface showed much less sprouting than trees cut at any other stump height. A careful study of the origin of these sprouts is in progress.

Woodland Grazing. Plans for remeasurement of the growth and yield and regeneration plots, established in connection with the woodland grazing studies, have been completed. Diller will have charge of these remeasurements again this year, with the assistance of a student paid by the Purdue Agricultural Experiment Station.

It is hoped that measurements can be started by the fifteenth of June. They will include the first 5-year remeasurement of the overhead stand on certain plots, in addition to the regeneration quadrats. It is also planned that certain management studies will be carried on cooperatively in connection with the Dubois County sustained yield project.

Forest Planting

Black Locust Seed Treatment. Chapman continued his experiments with the scarification of black locust seed. The need for a machine for such work has been expressed by federal nurserymen in R-9. Poor and delayed germination in beds during the season of seeding has been followed, the second year, by additional germination yielding less than a crop of seedlings from the dormant seed. As a result, Norman D. Koleman, superintendent of the nursery at Ware, and W. W. Grogen, superintendent at Junction, Illinois, plan to scarify most of the seed to be sown early in July at these nurseries.

Progress has been made during the month on the modification of the sweet clover seed scarifier, to handle black locust seed in quantity effectively. The present rate of scarification is a bushel in about 5 minutes.

To determine definitely the difficulties which must be overcome by scarification or any other method to increase the percentage of germination, Chapman has completed micro-chemical and anatomical studies on the seed coat of black locust. Results of these studies are being prepared by him and will appear in report form in the near future.

Nursery tests are being run simultaneously on black locust seed which has been scarified and untreated, to check the promptness of germination, and the percentage of seed germinating. A check of scarified vs. untreated seed on five samples in the seedbed showed an average of 2.51 times as many seedlings in the rows sown with scarified seed, or an increase in germination of 151% over untreated seed.

Nursery. Chapman made a trip to the Junction Nursery, Illinois, to start seedbeds of stratified shortleaf pine seed of Ohio origin, and of black locust to secure some stock for use next year. Because of heavy rains, the soil was too wet to work and portions of the site were under water. The seed, and instructions for planting, were left with E. T. Warner at Shawnee Branch Station. Myer has been completing the nursery beds at Columbus and weeding and tending them. A series of seedings of locust at two-week intervals have been started to determine the latest date for seeding which will produce stock with thoroughly matured wood, hardy to winter temperatures.

Black Walnut. Some time was spent by Kellogg on the manuscript of the Station's study of plantations of this species.

Seed Crop. Because of persistent cool weather and occasional freezing temperatures, the seed crop of American and slippery elms, and of red and silver maples, were ruined in central Ohio this year. Abundant flowers and setting of seed occurred in the latter part of March, but late freezes caused the dropping of seed when it was only partly developed. Plans to produce small quantities of planting stock of these species have been necessarily postponed, because of lack of seed.

Forest Soils

Auten has prepared a working plan as a basis for a comprehensive study of soil profiles in connection with the growth of conifers, planted and natural stands. Preliminary to the summer work, he has made some oxidation-reduction measurements on the soils of local woodlots near Columbus.

A short paper, "Successful Forest Planting Requires Better Site Appraisals," has been submitted to the Journal of Forestry for publication. It deals with a yellow poplar plantation found in southern Ohio, in which very good and very poor growth of trees only a short distance apart was explained by an analysis of subsoil conditions, although no differences in site were apparent on the surface.

Forest Insects

Locust Borer. Hall spent the first week of May on Long Island with Dr. H. J. MacAloney of the Northeastern Forest Experiment Station, making a study of borer damage to "ship mast" locust. Eighteen sample plots were established in the course of this study. The data have not been fully analyzed, but it is expected that a report will be completed on this work in the near future.

The work on the locust borer in Ohio has been progressing under the direction of C. R. Page and H. A. Waters. Work for May has been chiefly confined to observations on the development of young locust borer larvae on a number of study plots at Cambridge, Hopedale, and Minerva.

It appears that fermentation around attack points where larvae have died is much more prevalent this year than last. It is also evident that the work of the downy woodpecker has been responsible for considerable mortality to young locust borer larvae during the past month. Early spring mortality in young larvae has been much greater this season than last. The fact that precipitation so far

this season has very greatly exceeded that of the previous season, may be a contributing factor. Periodic sampling of soil and trees for moisture content has been started on all study plots.

Additional cutting experiments to determine the best time of year to cut locust to obtain maximum sprouting have been started. Cuttings are planned at about monthly intervals during the coming field season. Pruning experiments will be carried on along with the cutting work.

Certain selected study plots at Cambridge have been re-mulched with leaves to determine the effect of this treatment on site improvement and locust borer injury.

The Illinois work has been in charge of H. C. Secrest. He has been making larvae attack counts on the study plots in this State as well as on those located in Kentucky and Tennessee. He has also started soil sampling and growth measurement on all the Illinois study plots. A series of sample plots has been established in a mixed black locust and pine plantation at Elizabethtown, Illinois, part of which was pruned during the winter of 1934. This study is being made to determine the effect of added light on the underplanted pine.

Other Insects. Hall spent several days in southern Ohio on the Dean, Zaleski, and Scioto Trail State Forests to determine if any insect damage has become apparent on areas which have been thinned by the C.C.C. crews for timber stand improvement. No damage of any consequence was noted in any of the areas visited, although it is still too early to predict what may happen in the future.

Some injury to mature oak by the shoe string root fungus and the two lined chestnut borer was observed on the Zaleski Forest. The trees which were killed were all located along a new woods road which had been built through uncut timber. It appears that these may cause some concern along roadways or on building sites where trees are exposed to the direct rays of the sun.

Mr. Lee Strong, Chief of the Bureau of Entomology and Plant Quarantine, visited Columbus on May 13 and 14 and was able to spend about a half day on the Carnes Experimental area at Cambridge, Ohio, inspecting the work which is under way on locust borer control and management studies on black locust.

LAKE STATES FOREST EXPERIMENT STATION

Shelterbelt Soil Surveys

Mr. F. A. Hayes, of the Bureau of Chemistry and Soils, under Station direction is supervising the work of three field parties engaged in soil surveys for the Shelterbelt Project in Oklahoma. These parties will survey intensively one township in each of a number of counties selected by the Shelterbelt office in Lincoln, Nebraska. The purpose of the surveys is completely to classify the soils and make recommendations for shelterbelt locations on the basis of the soils, topography, present land use and ownership.

The parties are composed of one experienced soil surveyor and one junior forester. It is contemplated that the training afforded the junior foresters will enable them to classify land offered or considered for purchase for large scale shelterbelt planting.

Shelterbelt Report

The drive to finish the Shelterbelt Report continued during May and definite progress was made through the assignment of an editor, Mr. Mosley, from the Forest Products Laboratory.

Nursery Experiments in North Dakota

As a result of the approval for purchase of several tracts of land for National Forests in North Dakota, interest in developing good planting stock for this region has been aroused. The Station has carried on experimental work in planting in the sandhills of this region for a number of years and has already accumulated considerable reliable information on the subject. This year the work is being expanded by the development of a National Forest Nursery at Towner, North Dakota. A large number (400-500) of small experimental nursery beds are being planted, about 2/3 of the number in the National Forest Nursery. Variations in density, fertilizer and other treatments are being tried out. A new machine has been developed for making the seed furrows. This machine makes five furrows at a time, and is working out very satisfactorily.

Experiments with Aspen Hybrids

So much of the Lake States is covered with aspen and conversion of these stands is so difficult in some situations that it is deemed advisable to grow aspen on certain areas. There is a good market in some localities for first quality aspen and it appears

likely that increasingly large volumes of this species will be used. However, much of the aspen in the present stands is of poor quality and relatively slow growth. Experiments with a number of aspen hybrids are being carried out by the New York Botanical Garden in cooperation with the Oxford Paper Company, Rumford, Maine, for the purpose of discovering varieties which have the much desired characteristics of hardiness, freedom from susceptibility to rot, and rapid growth. The Station is cooperating, and this spring, several thousand cuttings of varieties developed in the Northeast were set out on the Pike Bay Experimental Forest at Cass Lake, Minnesota and at the North Dakota branch. Also, local cuttings of one year old sprouts and local root cuttings were planted on the Pike Bay unit. So far all the plants are doing very well and have already put on an inch of growth in many cases.

Cultural Work on Paul Bunyan State Forest

In accordance with a request from State Forester Conzet of Minnesota, Eyre inspected the Paul Bunyan State Forest in order to help the State formulate a program of cultural work. This area south of Itasca Park of about 32,000 acres of land in state ownership, recently acquired by means of tax abatement on other lands, originally was covered with a magnificant stand of Norway and white pine. Logging and fires, however, have almost completely denuded the tract of coniferous growth both of seed trees and advance reproduction. The area is now almost completely in aspen. The soil, although of good quality for the reproduction of pine, is average and below for aspen. Moreover, the aspen, mostly about 20 years of age and 20 to 30 feet tall, is quite generally infected with decay. This young growth does not appear of good enough quality to warrant cultural work for the improvement of the aspen stand.

Obviously, conifers should be introduced. The upper slopes and ridge tops, if some of the brush were removed, could probably be successfully planted to Norway and jack pine, and by means of scarification of the surface of the soil around the scattered seed trees that remain, some regeneration of pine could, no doubt, be encouraged. On the whole, however, this tract, for the next few years at least, will be much more valuable for the production of game than of wood products.

NORTHEASTERN FOREST EXPERIMENT STATION

General:

Word has been received that the trustees of Williams College have voted to deed to the government a tract of 1,600 acres for use as an experimental forest. This tract, adjacent to the College, will serve for studies of the rehabilitation of lands formerly used largely for agriculture and now in various stages of regrowth. It will also lend itself well to studies of forest influences and to the interrelation of game management with forestry.

A special act of Maine legislature authorized Bates College Estate to sell certain forest lands to the United States government for experimental purposes, and acquisition procedure will be started as soon as funds are allotted for the purpose. It is proposed to acquire as an experimental forest a portion of the Bates College Forest which has been under management for 12 years with accurate records of growth and cut for that period. The tract will give the Northeastern Station an experimental forest in the white pine region.

Behre and Westveld accompanied Forsling, Baker, and Demmon on a week's trip in the Southern Appalachians. The party visited the Tennessee Valley work and also 3 of the experimental forests of the Appalachian Station. Special attention was given to erosion-streamflow installations. After leaving the men from the other Stations who continued South, Behre and Westvelt visited the Black Mountain Natural Area to learn something of virgin spruce in the South, and also the Duke Forest at Durham, North Carolina.

Planting:

Doctor Stewart has initiated a series of plots at the Chenango Experimental Forest which will be supplemented periodically thruout the season to test the effectiveness of sodium arsenite and calcium chloride in the poisoning of weed trees on areas to be planted. The growth to be poisoned consists largely of aspen, fire cherry, and hawthorn.

Experimental plantings were made to work out methods of establishing conifers and hardwoods. In order to encourage best form in white pine the experiments include setting out groups of several sizes in which the trees are closely spaced, arranged so as to keep the total number of trees planted per acre down to about 1500.

Spruce Management:

Cutting of scattered and inferior hardwoods from spruce sawtimber compartments on the Gale River Experimental Forest by the Civilian Conservation Corps yielded a total of 615 cords from 43 acres. The successful handling of this job by the C.C.C. boys illustrates the feasibility of making improvement cuttings of this sort without material damage to the softwood growth into which the hardwoods had to be felled.

Fire Committee:

The Forest Fire Committee of the New England Section, Society of American Foresters, of which Stickel is a member, is planning on a general forest fire conference which is to meet late this summer in connection with the summer meeting of the Section. It is hoped to make this conference an annual affair to serve as the means of acquainting foresters with the fire problems of the various Northeastern States. This year the conference will meet in Connecticut; several recent fires will be inspected as well as recently developed protection roads and the latest type of power equipment. It is expected that the Station will be able to show the members of the conference some of the fire damage investigational work being done on a recent burn on grounds of the Yale University Golf Course near New Haven. Invitations to attend this conference will be sent to all the state forestry organizations of New England, New York, New Jersey, Pennsylvania, and Maryland.

Fire Damage:

Assisted by Ranger Spinney and a crew from the Saco River Civilian Conservation Corps Camp, Stickel reburned the Bartlett experimental burn plot early in May. Altho the burn this year was more successful than last year as far as area burned is concerned, the intensity of burn obtained fell far short of expectations. This is particularly true when the Bartlett burn is compared to some of the natural burns being worked on in the southern part of the region. Factors which probably contribute to this difference in fire intensity between the northern and southern parts of the region are the greater matting of litter in the north due to heavier and more lasting snow cover, and the absence in the north of such fire-carrying undergrowth as mountain laurel. The greater fire damage susceptibility of beech in comparison with its associated species is well illustrated at Bartlett by the fact that the bark at the base of many beeches is dead, even though such trees show no visible signs of scorching from last year's fire.

Mensuration:

Considerable difficulty has been experienced in developing basic form tables for northern hardwoods, for preparing tables of merchantable volume in cubic feet and board feet by D.B.H. and merchantable height.

The first attempt, thru linear multiple correlation of upper diameters with D.B.H. and height above ground gave rather anamalous results, especially for the first 10 - 12 feet above ground. For the small D.B.H. classes the estimated D.I.B. at 4.5 feet was greater than the D.B.H.O.B. For the large D.B.H. classes the D.B.H.I.B. was much underestimated, indicating a double bark thickness of as much as 5 inches, 2 1/2 times the actual thickness of the thickest-barked species in the group.

The linear multiple correlations had been examined for curvilinearity, but the slight amount present was thought to be insignificant. However, when the results indicated above were obtained, the charts were corrected for curvilinearity, which developed to greater extent than expected. The final charts, when critically examined, showed improvement in the upper diameters, but the diameter estimates of the first log were as untenable as those from the linear correlation charts.

Since the multiple correlation method is not adapted to the development of stem form charts, an empirical chart form was sought. Analysis of existing form tables indicated that, with parallel straight axes for D.B.H. and upper diameters, the height axis should be curved and should cut the upper diameter axis at zero inches. With this lead, and with prior knowledge that the D.B.H. and upper diameter scales must maintain, because of bark thickness, a fixed relation to each other and to the 4.5 feet height point thruout all scale revisions, it became possible to construct empirical alinement charts of stem form. In final form these charts have moderate curvature in the D.B.H. and upper diameter axes, and very marked curvature in the height axis.

The final charts are as easy to use as any three-axis chart, but the technic of developing the scales and the axial curvature is complex, difficult of description, and applicable only to the specific type of chart described. Derivation of statistical measures of accuracy in volumetric units entails a large amount of additional labor useful for this purpose only.

Miscellaneous:

Additional observations on nail damage to tagged trees on permanent sample plots were made during May. Although the new data have not been fully analysed, the following points hold true for all trees studied:

1. Damage occurs on trees whose bark has not cracked, as well as on those which have bark cracks.

2. The sapwood is discolored and obviously killed to a depth equal to the point of penetration of the nail.

3. The size of the wound is larger on hardwoods than on red spruce or hemlock. The wound on the hardwoods is usually diamond-shaped, the widest portion being at the nail. The vertical points extend to several inches above and below the nail. The wound on the softwood is usually circular, seldom being more than a quarter of an inch in diameter, the nail being in the center of the wound.

4. A callus growth is generally rapid, and wounds may be expected to heal in about 3 years. On beech the extent of the callus can often be determined by a ridge extending above and below the nail for several inches. Some callus growth was observed to have a thickness of 0.3 inch.

5. The rapid healing of the wound may account for failure to observe wounds of this nature on permanent sample plots which are not remeasured sooner than 5 years after establishment.

6. A common wound on beech is apparently caused by hitting the bark with a hammer when the nail is driven. Numerous cases of this kind were observed. Such wounds are diamond-shaped, with a callused margin, and generally are still covered by the bark. They seldom extend more than 2 inches either vertically or horizontally.

NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Silviculture

Haig wound up his work at this Station and left for Washington on a transfer to the Silvics office.

During the past month, Davis completed a short paper for publication describing statistical methods used to determine the reliability of height-over-diameter regression lines. Determination of the accuracy of such regressions was of particular importance in connection with the recent installation of a Latin-square series of thinning plots on the Deception Creek Experimental Forest, as it was necessary to learn definitely whether a single height-over-diameter curve for the series as a whole could be used in computing volumes at the time of thinning, or whether the height-diameter relation differed among subplots to such a degree that a curve should be constructed for each subplot.

Regression lines were computed by the method of least squares for each of 11 subplots representing as wide a range of conditions as could be found on the plot. The regression lines fitted the original data satisfactorily. Standard errors of the regression coefficients describing the height and slope of the regression line were calculated and then combined to determine, for each subplot, the standard error of the regression line as a whole or for any particular point on the line.

From these standard errors, the significance of differences between subplots of average tree heights, as estimated from their respective regression lines, was determined for the various diameters included in the range of data studied. It was found that in only one or two instances were there significant differences between sub-plots. It was consequently decided that in this instance a single height-diameter curve for the plot as a whole could be used to compute volumes at the time of thinning without introducing any serious error into the calculations.

Forest Products

Stumpage price compilations for 1934 were completed during the month. The volume of transactions was considerably greater during the past year than in 1933. Sawtimber transactions reported amounted to 333 million feet, valued at $141,000, compared to 200 million valued at $76,000 in 1933. Western white pine sawtimber, as usual, topped the list with a high individual sale price of $7.96 per M. Western red cedar pole stumpage led all species at $17.95 per M when converted to a log scale basis.

Preliminary lumber census figures for 1934 indicate a cut of 356 million feet of western white pine which represents an increase of 22% over the 1933 cut. Approximately 90 million of the 1934 production, or 25%, was cut in the form of match plank. In 1933, 100 million out of a total production of 292 million feet, was manufactured into match plank. Not all of the match plank is used for match manufacture but it is safe to figure that 90% is used for this purpose and the other 10% sorted out and sold as commercial lumber.

Since it has developed that the match industry absorbs such a large proportion of the western white pine cut, a canvass of match plank production will be conducted biennially.

Experimental Forests

Priest River

Field work at this station largely began with the arrival of the full quota of the Priest River CCC camp, except the local experienced woodsmen quota, on May 4. A total of 135 men were turned over for project work on Monday, May 6. The turnout for May has been from 125 to 140 per day but during that time the camp has been rebuilt completely and is over 90% completed as a summer camp. Plans call for the construction of winter camp buildings to be started during the month of June. The following are major items in the varied camp program.

Arboretum planting for this spring contemplates planting in a total of about 38 blocks, in which replacement planting will be made in about 20 blocks and new planting in 18 blocks. Over 36,000 seedlings, including 44 native and exotic species, have been ordered. A few other experimental areas are also to be planted.

Stand improvement work planned consists of completion of hemlock and defective timber disposal on cutover areas already partially treated, and if possible the presale disposal of hemlock and other low-value species on an area scheduled for logging in the near future. The purpose of removing these unmerchantable species in advance of logging is to create shelterwood conditions favoring prompt and abundant regeneration of the more valuable species, principally white pine and cedar. When reproduction is established, the remaining stand, consisting entirely of merchantable timber, will be clear cut.

Thinning will be continued in thinning areas already established to complete the present series of thinning plots and to provide areas for duplicate plots to strengthen the present plot setup. It is hoped that extensive thinning work in Canyon Creek may be begun.

Other major jobs planned include the construction of four short spur roads totaling 8.5 miles; burning of slash and other debris along 23 miles of new road; extensive hazard reduction work; maintenance of telephone and power lines, trails, buildings, fences, etc.; and rodent control. A number of men from the camp will also be used on several research projects.

Deception Creek

Work began at Deception Creek with the arrival of the CCC camp. The first large job was an extensive bug control project. Approximately half of the man power of the camp is being devoted to this. Other major jobs now being done or to be undertaken are:

Extensive thinnings in a 40-60 year old white pine stand which will be followed by a series of thinning plot installations.

Weeding and cleaning work in 15-year-old reproduction in an old sale area. Excellent white pine reproduction is undergoing severe competition from hemlock and white fir. Residual white pine seed trees are to be removed during the summer by means of a small timber sale. This work will also be followed up by the installation of a series of permanent sample plots.

Pre-sale disposal of hemlock and other low value species will be done in an area scheduled for early cutting on the same general plan as followed on a similar project at Priest River.

Several short utilization and protection roads within the experimental area, the Region plans to construct a high-grade utilization road directly to Coeur d'Alene, which will add immensely to the value of Deception Creek as an experimental area by making almost any kind of small sale practicable.

Other jobs include extensive roadside cleanup, landscaping of the Station grounds, blister rust control, and a variety of minor research and improvement projects.

Surveys of Experimental Forests

Final office work was completed this month on an intensive forest management survey of the Priest River and Deception Creek Experimental Forests in the western white pine type and in the Coram Experimental Forest in the larch-fir type of western Montana.

The field work consisted of: a 10% stand and volume inventory of reproduction, poles, and mature timber classes; timber type and age class mapping by standard classifications: complete topographic mapping; survey of all basic detail, including boundaries, roads, trails, and improvements; boundary location and posting; detailed

Administrative Site maps; location of section lines and public land corners; and the establishment of Reference Meridians.

Essential figures for the three areas are as follows:

Experimental Forest	Area (acres)	Gross Volume Scribner, 12"- M.B.M.	Net Merchantable Volume M.B.M.	Management Compartments
Priest River	6,368.3	62,655	12,309 (WWP)	11
Deception Cr.	3,516.7	69,469	36,551 (WWP)	10
Coram	7,244.5	93,297	85,072 (WL-DF)	4

On the Coram Forest, 2,207.3 of the total 7,244.5 acres were completed in the present survey. For the remaining area, the stand inventory and the timber type and age class maps remain to be finished. For this reason it was impossible to construct stand tables for Coram. Data from a previous timber survey in 1916 provided supplementary figures in compiling the report.

The completed reports are separately bound in atlas binders, and all typewritten material is typed on vellum paper so that duplicate prints may be readily made.

The report for each experimental forest includes the following: a comprehensive report; separate maps for timber types and age classes (both colored), topography, cruise plots, and site location by drainage and management units; samples of forms, site curves, and volume tables used; timber type and age classifications, and special inventory instructions; summary tables showing Scribner volumes by both legal subdivisions and management units, acreages of the forest classified by the same two divisions,acreages of timber types and age classes by management units, and stand tables (except for Coram).

The Division of Engineering in the Regional Office plans to construct relief maps for each of these experimental areas based upon the topographic maps just completed.

PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Section of Forest Products

Forest Research Notes No. 16 of June 1 is a Forest Products issue, containing nine abstracts of products projects under way or recently completed. Several of the articles are being reprinted in the trade journals.

Lodewick was called to advise on replacing a floor destroyed by dry rot. The trouble occurred in a basement room in a 15-year-old house on Portland Heights. A hemlock floor had been laid on sleepers set in concrete which was none too thick, and which was kept moist by seepage. Half of the floor was infected two years ago and had been replaced, the sleepers and all the concrete being given a thick coating of tar. This treatment was apparently effective and was advised as the cheapest method of treating the half now infected.

The Section of Products was called upon for pole durability data and advice as to effectiveness of various preservative treatments by the Rural Electrification Division of the SERA.

A consultant for the U. S. Engineers has asked the Station to consider the desirability of summarizing the possibilities of charcoal production in the Pacific Northwest, especially to supply the needs of electro-chemical and metallurgical industries to be attracted by Bonneville power.

The 1934 lumber census was completed during the month. A total of 1,891 approved schedules were submitted to Washington.

A few days were spent on the production study report of the mills studies last fall. The York Lumber Company, cutting 4 M per hour, was selected as sawing representative second-growth logs on which additional data are needed for grade descriptions. The mill was worked for three days, during which time 411 logs were analyzed. A few more days will be put in the first week in June.

Forest Survey

Douglas fir region. Steady progress has been made on the unit reports with most of the regular staff working on this job. By June 1 seven unit reports were completed, and of the remaining four, two were 70 per cent complete, one 65 per cent complete, and the last one 50 per cent complete.

Ponderosa pine region. Seventeen men were working in the field in May, three in southeastern Oregon, two in the southeast corner of Washington, four in north-central Washington, and eight in south-central Washington. Much of the nonforest land, the scattered pine woodland and juniper types has been scouted and mapped, and the type mapping and estimating are now narrowed down to the strictly forest country at higher elevations.

The 1/4-inch-to-the-mile type boundary map for the northwest quarter of Oregon was received from the U.S.G.S. at Washington, and the drafting force started work coloring out the different type patterns on the various color sheets.

Forest Economics

Logging Engineering Economics. Brandstrom returned from Washington, D.C. on May 14 after spending three and a half months with Kirkland on rewriting their joint manuscript "Principles and Procedures of Selective Timber Management in the Douglas Fir Region".

Ponderosa pine logging studies. Brandstrom and Rapraeger on a 10-days trip through eastern Washington and Oregon in preparation for the proposed studies of selective logging in ponderosa pine contacted logging and milling operators who would be willing or anxious to cooperate in the proposed studies and to select suitable study sites. About ten different operations were visited and interviews were held with the principals of these firms to explain the purpose of the proposed studies.

Land Economics. Wilson and Kearns have completed a study of the relation between tax delinquency and forest cover by size of ownership for nine counties each in western Oregon and western Washington, and made a more intensive correlation for five school districts in Columbia County to show the relation of lay of the land to cover and tax delinquency in cut-over, in burned-over, and in agricultural lands. An analysis was made of the influence of slope upon the use of land for agricultural purposes in a part of Clallam County, Washington, and the same thing is under way for Columbia County, Oregon.

Statistical compilations on agricultural development in each state were prepared by Wilson, Kearns, and assistants, for use in studies of the relationship of forest to other uses of land, using Census data for the period from 1880 to 1930.

Mensuration

Spruce-hemlock yield study. All of the yield and stand tables are now finished and emphasis is being placed on the study of several principles of application, such as the use of the stand density index,

the effect of composition, the determination of site, the effect of region and allied problems.

Ponderosa pine yield study. This study is still practically at a standstill, since regional differences in data are too great for the application of the usual methods of yield table preparation. Determination of site is the first difficulty to be overcome. Anamorphic construction of site index curves is out of the question, and other methods rendered difficult because of the weakness of age classes in certain site classes and the effect of stagnation in others. Bruce's and Schumacher's method using the variation of data about the graduating curves has for this reason proven unsatisfactory, and has lead to unreasonable results.

Section of Silviculture

Because of a need for summer range for herds from drought-stricken regions of eastern Washington and Oregon, the use of Douglas fir cut-over lands for summer grazing of sheep has come into prominence this spring. Isaac attended two meetings held in Columbia and Clatsop Counties (Oreg.) to foster this movement. There are now approximately 25,000 sheep on summer range in these counties.

If properly handled summer grazing of sheep may not be inimical to forest growth. The areas can be lightly grazed without damage to coniferous reproduction and as the regeneration claims area after area the sheep can be shifted to new cuttings. The danger lies in the fact that semi-permanent settlers may be attracted by the movement; if so, they will fight the oncoming forest with fire, grass seeding, year long grazing, overgrazing, or any means at hand, and brush fields will be developed on these highly productive forest lands.

Experimental forests. Forest cover studies by ECW crews on our four experimental forests are now in report form. The areas covered by the surveys are as follows:

Name of forest	Location	Area in acres	Forest type	Vol. conifers in M bd. ft.
Wind River	Columbia N. F.	10,185	Douglas fir	332,775
Cascade Head	Siuslaw N. F.	6,145	Spruce-hemlock	310,589
Pringle Falls	Deschutes N. F.	7,680	Ponderosa pine	92,165
Blue Mountain	Whitman N. F.	11,471	Ponderosa pine	90,454

Pringle Falls Experimental Forest. The polewood resulting from thinning ten experimental plots has brought on an infestation of engraver beetles (Ips oregoni, Eichh.) in the vicinity of the areas treated. On several plots considerable damage has been done by the beetles. A project was started early in the month in cooperation

with Entomologist Keen of the Forest Insect Station to determine the conditions favoring or retarding serious Ips damage.

A CCC crew has continued intensive cruising of a tract in the heart of the Port Orford cedar belt, where it seems very desirable to set up an experimental forest. Here grows with great luxuriance and rapidity the most valuable conifer of the west, and here present practices have been quite inimical to the perpetuation of this type. Research here should yield good dividends in pointing the way to methods of increasing the proportion and production of Port Orford cedar.

Fire Studies. Matthews attended the Oregon fire wardens' meeting at Salem and gave a short talk on the fire danger stations and the visibility meter. This group was keenly interested in this new equipment and in the philosophy of giving the men on the ground the means to measure some of the important variables that affect fire danger instead of making guesses or referring to a very few measurements made at widely separated points.

An analysis of the reports received from Region 6 and also from the other regions throughout the country indicated that the use of the eye test developed by McArdle and Byram in 1932 should be continued. Cooperation was given the Regional Office in the preparation of a circular letter of instructions relative to the continuation of the lookout eye tests at the guard training camps as part of the process of selecting the proper men for lookout duty.

Morris reviewed Dr. O'Day's progress report on the study of the static conditions in the atmosphere prior to and during lightning storms. Dr. O'Day, an instructor in the Physics Department of Reed College, has been conducting studies of static, using various locations in the Blue Mountains under a cooperative arrangement with the Forest Service, with the objective of determining how to use measurements of static intensity in the prediction of thunder storms.

SOUTHERN FOREST EXPERIMENT STATION

General

Miss Helen Moore, Librarian of the Washington Office, spent ten days in the New Orleans office. During that time she was able to review our library problems, offer a number of very important suggestions which cleared up questions of long standing, and worked with our personnel enough so that everyone benefitted by the exchange of ideas.

Forestation

A report was completed of the life history of slash and longleaf pine while in the nursery. Curves of growth of tops and roots of longleaf and slash pines derived from measurements taken at frequent intervals in the study in 1934 showed a definite periodicity of root and top growth. Root elongation was rapid for the first 40-60 days following germination, and needle elongation did not increase until the fascicles had appeared in middle July. Root elongation stopped about this time, and lateral roots and stem diameter developed. The needles of longleaf and both the stems and the needles of slash, elongated rapidly until early in October. Needle and stem elongation then stopped, the terminal buds began developing, and root elongation began once more. The photographs taken at regular intervals through the growing season show the changes in the seedlings even more vividly than the curves.

The first examination of field survival in the root exposure study was made early in May. This study comprises 3,300 longleaf and 3,300 slash pine seedlings which were exposed to the sun and wind during the lifting process. The periods of exposure ranged from 0 to 30 minutes under three representative sets of weather conditions; occurring, respectively, on a bright, windy forenoon, a bright, windy afternoon, and a windy, cloudy day. In accordance with the Station's general practice of using four replications in forestation studies, 100 seedlings subjected to each type and length of exposure were planted in separate rows of 25 trees each, with one row in each of four blocks. These data were analyzed using Fisher's Analysis of Variance.

The analysis shows that all factors, namely day, period of exposure, species, and their interaction are significant factors of variation. Some difficulty has been encountered in obtaining the true effects of exposure because of damage from such agencies as gophers, ants and rabbits. There is evidence, based on computations made to date, that mortality has a tendency to increase for seedlings which have been exposed for three minutes or longer.

The mortality is greater for those exposed on bright days. For no exposure interval was there 100 per cent mortality of seedlings at this first examination (two and one-half months after planting). It is believed that the fall examination will show the mortality per cent to be greatly increased.

At the Stuart Nursery 11 inches of rain on May 18 and 19 flooded large areas, including the Station's 40 experimental beds. Little damage to the Station's beds resulted, except that the margins were marred, and in several tests ungerminated seeds, which were to be removed and subjected to cutting tests, were washed away. Only 12 small plots, the next to the last series sown in the "season of sowing" tests, have had to be abandoned. Even on these one germination count had been obtained before the rain. It is estimated that the rain destroyed approximately 1,000,000 seedlings in the administrative beds.

Financial Aspects

Arrangements have been made to cooperate with the Southern Pine Lumber Company of Dibol, Texas, in a study of selective logging of second-growth loblolly and shortleaf pine. An area, probably on the Davy Crockett National Forest, will be marked for light cutting of the trees of larger diameters and an improvement cutting of the trees of smaller diameters. The trees marked for removal will be those which give least promise of future earnings. The possibility of making the area a permanent sample plot is an obvious advantage when located in a national forest.

Forest Survey

The field work of the Survey for Louisiana is now complete and arrangements have been made to move a number of the Louisiana field crews into southwestern Arkansas. The field work for Units 2 and 3 of Alabama is complete and the field crews have been moved into two new units comprising about 11 million acres in the same state. These new units lie in the upper coastal and piedmont areas.

Putnam completed the economic work in the delta units and with Andrews was called to the Station to start work on the final reports. Girard arrived from Washington and started volume table work that will ultimately cover 30 million acres in Mississippi, Louisiana and Texas. Lemieux and three field men are assisting in this work.

Pathology

Three Louisiana nurseries were visited by Hatfield and observations were made of nursery practices and of fungi contributing to lowered seed germination and fungus attacks in the seed beds. At one pine nursery it was found that many seeds while in storage had

been rendered useless by a soft rot caused by a species of Rhizopus. Two other fungi of general occurrence were isolated from stored seeds and from the seed beds, but they have not yet been identified. At another nursery where black locust was important, observations were made on the relation of soil pH to disease occurrence and plant vigor. Best plant growth and the least disease were encountered in well-drained soil having a pH of 5.15 and the most disease was found in soil having a pH of 7.75.

Where hot water treatment is used to hasten germination of black locust seed, care should be taken to dry the surface of the seed immediately after such treatment, otherwise molding will occur and infection of the seedlings will be more liable to take place if weather conditions favorable to fungus growth follow the seed planting.

Entomology

Snyder inspected the Monsanto Chemical Works' experiments with chemical sprays which are designed to protect green logs and lumber from attack by ambrosia beetles. One chemical has given 100 per cent protection over a period already about six weeks duration; coal tar creosote did not give complete protection. Soil poison tests against termites were enlarged. He also with the help of Hatfield, installed chemical-spray tests to protect green lumber from ambrosia beetles and sap stain at Natalbany, La.

Snyder attended the conference of the Building Officials of America at Indianapolis, Ind. An illustrated address was delivered on preventing and remedying termite damage. Special emphasis was placed on the mandatory sections of city building codes to prevent termite attack in buildings. It was urged that such provisions be adopted generally.

Biology

Laboratory work was inaugurated by the analysis of the contents of five stomachs of Savannah Sparrows (Passerculus sandwichensis savanna) taken at the Forest Nursery at Stuart, La. Birds have been considered exceedingly destructive to the seed beds in this nursery, and it was to determine just how serious this damage was that these birds were killed. Fragments of pine seed, varying in amount from 25 to 95 per cent were found in all the stomachs examined, and indicated the necessity of some means of control until seed sown had germinated.

SOUTHWESTERN FOREST AND RANGE EXPERIMENT STATION

At the annual meeting of the Southwestern Division of the American Association for the Advancement of Science held in Santa Fe, April 29 to May 2, the following papers were presented by members of this Station:

Biological Science Section

The Reptiles and Amphibians of the Jornada Experimental Range, New Mexico - Elbert L. Little.

Observations on the Reaction of Pine Seedlings to Shade - G. A. Pearson.

A Study of Drymaria holosteoides, a Poisonous Plant of Southern New Mexico - Elbert L. Little.

Symposium on "The Ecological Aspects of the Emergency Operations of the Government"

The Role of Ecology in the Improvement of Forests - G. A. Pearson.

Symposium on "Trees as Recorders of History and Climate"

Factors Influencing Tree Growth - G. A. Pearson.

Jornada Experimental Range

An entire CCC camp has been employed on the Jornada during the past 6 months. Much work has been accomplished on fence building, water development, road construction, planting, landscaping and recreational development. Among the research projects is an 80-foot square rodent exclosure near New Well and two 160-acre exclosures in black grama and tobasco types.

A belt transect 1,500 feet long and 1 foot wide was established and charted in a cattle exclosure southwest of Headquarters in Pasture 2. This transect extends from black grama through Gutierrezia or snakeweed to mesquite dunes and when recharted in later years will show changes in these types.

Fort Valley Experimental Forest

A CCC crew of 20 men is now engaged in stand-improvement work in the Fort Valley Experimental Forest. Present plans contemplate working a section of old cutover land during the next 6 months. The cutting practice on this section is very conservative, being limited largely to light release and pruning of crop trees and removal of wolf trees and badly mistletoe-infected specimens. This practice is intended to put the forest in good silvicultural condition and at the same time the stand in suitable condition for further experimental cutting.

A new series of experimental plots in timber stand improvement is being established. The purpose is to study the reaction of crop trees to different methods of treatment and to obtain information on the number of crop trees required per acre. The experiment provides for a series of plots in light and another in heavy release of crop trees. Under each of these systems there will be three plots leaving 80, 120 and 160 crop trees per acre.

Santa Rita Experimental Range

The rodent-control campaign on the Santa Rita, being conducted by the U. S. Biological Survey, has been practically completed with almost complete eradication of small rodents and the killing of slightly over 10,000 jack rabbits and 1,600 cottontails. This removal of rodent pressure comes at a very opportune time when forage was short due to 2 years of drouth; the absence of rodent pressure should make very considerable difference in the amount of forage available for the cattle, and minimize the experimental error caused by rodents in vegetative measurements.

RESEARCH IN REGION 2

Roeser attended the annual meeting of the Southwestern Division of the A. A. A. S. in Santa Fe during the week of April 28, and also was present at the Supervisors' meeting, which was held in the Regional Office, the last week of May. His time in the intervening period was divided between the Colorado Springs office and the Fremont Branch Station. Most of the office time was given to preparing a biennial report summarizing the results of investigations carried on since January 1933, when the last Research Council meeting was held.

Degrees of cutting in the Engelmann spruce type on the Holy Cross Forest, (Mc-146):

During the past year, remeasurements made on experimental plots on the Holy Cross Forest now provide information covering a 20-year period of growth on three plots in the sub-alpine spruce type and a 10-year period in the lower slope spruce type with an admixture of lodgepole pine. In stands of the former type, averaging 25,000 to 30,000 board feet per acre, the best increment has been obtained where 40 per cent of the original merchantable volume was left as compared with residual stands containing 46 per cent and 28 per cent of the volume of the original stand. The margin between the 40 per cent stand the 46 per cent stand was not large in the matter of gross increment, but a fairly large margin in net increment in favor of the former exists and this margin probably is due to the presence of fewer over-mature trees in the 40 per cent stand and to a concomitantly lower mortality hazard. The heaviest cutting resulted in a relatively low net increment rate, the net periodic increment per acre-annum amounting to only 25 per cent of the gross periodic increment per acre-annum, indicating that a heavy loss in capital stock may be expected when the stand is opened too much.

In the spruce-lodgepole type the results, for stands averaging 15 M to 20 M board feet in volume, are more interesting from an academic than from a practical standpoint, since both degrees of cutting employed represent extremes in logging practice that would hardly obtain under ordinary timber sale operations. In the case of one plot, all of the lodgepole pine and merchantable spruce and fir was removed leaving only 20 per cent of the original merchantable volume in the residual stand. In the case of the other plot, only mature and decadent lodge-pole pine trees were removed and the residual stand is not very thrifty, even though the stand is relatively young as compared with the average run of commercial spruce stands. As a result neither plot has put on the increment that might have been expected had more practical

considerations governed the logging operations. The heavily cut-over plot is restocking itself very rapidly and the rapid growth of the reproduction is reflected in a higher rate of net cubic foot increment for this plot. Because of the relative absence of trees in the older age classes, the aggregate increment in merchantable volume has been less than on the quasi-control plot. However, the margin between net and gross increment is much smaller on the former area than on the latter, and this margin may be considered a relative measure of the effectiveness of silvicultural management.

In the following tabulation the more pertinent data relating to these plots are briefly summarized:

Sub-alpine spruce type, 25 M - 30 M bd. ft. per acre

No. of plot	Residual volume		Percent of original volume left		Periodic increment per acre-annum			
					Cu. ft.		Bd. ft.	
	Cu. ft.	Bd. ft.	Cu. ft.	Bd. ft.	Net	Gross	Net	Gross
B - 2	3536	14575	49	46	33.6	51.0	143	223
B - 1	3057	11984	44	40	42.5	53.9	192	231
B - 3	1937	7299	32	28	12.2	33.6	31	124
Lower slope spruce-lodgepole type, 15 M - 20 M bd. ft. per acre								
C - 2	4449	15792	80	77	17.4	45.0	117	188
C - 1	1062	2786	26	20	22.9	38.5	77	88

Degree of cutting in Black Hills ponderosa pine, (Mc-101):

The record of growth for the first decade following cutting in better quality stands of saw-timber pine in the Black Hills indicates that the net increment of stands having residual volumes of approximately 3200, 5000, and 5300 board feet is practically equal (about 100 board feet per acre-annum), in other words, the percentage of increment varies inversely with the volume left after cutting. For the stands in the order listed above, the periodic increment rates were respectively 3.24 per cent, 2.01 per cent, and 1.87 per cent per annum. By and large, the stand on the experimental area is thrifty, although a portion of the mature residual stand, which includes three age classes, 145, 185 and 240 years, is distinctly suppressed. A dense understory of 2 to 3-inch saplings is to be found on such parts of the area where openings occurred in the original canopy. The presence of this understory appreciably affects the cubic volume increment in the variously cut

stands; where the heaviest cut was made conditions are best for the rapid growth of the advanced members of this understory and the more rapid elimination of its suppressed members. For the first decade after cutting, the gross increment, or potential yield, of the stand with the smallest residual volume (1150 cubic feet) was 49.0 cubic feet per acre annum, while that of the stands on the other plots that contained 1482 cubic feet and 1820 cubic feet, was respectively 37.6 cubic feet and 39.9 cubic feet per acre annum. Losses during the decade have been relatively small.

Thinning in ponderosa pine, Mt-101:

In the study of the natural rate of thinning in ponderosa pine stands of "doghair" reproduction in the Black Hills, which was started in 1906, a 27-year record is now at hand. On two of the three plots involved in the study, no thinning was done, the stands being left to themselves. Two degrees of stocking were represented. On the one plot, 56140 trees per acre established themselves between 1906 (when the average age was 7 years) and 1912. In 1933, 16,380 trees per acre, or 21 per cent, survived. The average breast high diameter of these trees was 1.388 inches, and the average height of the dominant trees 16.63 feet. On the other plot, in a more openly spaced stand, a maximum number of 18490 trees suffered at 31 per cent loss, 12700 trees, which still represents a badly overcrowded condition, per acre remaining in 1933. The average diameter of these trees, 1.503 inches, is somewhat larger than that of the more densely stocked plot since the competition has not been quite so keen, but the average height of the dominant trees is less than on the other plot, being 15.54 feet. Some of this difference may be attributed to poorer site.

A third plot was thinned in 1919 to 3280 trees per acre. During the first half-decade after thinning a heavy mortality was experienced, probably due to sudden release and exposure. Since 1924 there have been no losses. The average diameter of this stand was 1.783 inches in 1933 and the average height of dominant trees 16.57 feet. The effect of thinning has been to increase the rate of diameter growth for the last 9-year period, 1924--1933, from 80 per cent to 145 per cent over the rate on the two unthinned plots, but has not resulted in any stimulation of height growth.

Seed production in Douglas fir, Fs 161 (c):

What promised to be a very early spring proved in the end to be a late one in the Central Rocky Mountain region owing to the unseasonally cold and wet weather that prevailed between April 17 and June 1. The weather situation, mention of which will be made later, has been distinctly favorable to Douglas fir from a flowering and prospective seed production standpoint, since the unfavorable weather broke just prior to the time when the first buds were about to open, and persisted uninterruptedly about 6 weeks, or beyond the

time when the normally early-emerging flowers are exposed to the danger of freezing by late spring frosts. As a result, this species is blossoming unusually late. In spite of heavy seed production in 1934 and a series of very dry years, another heavy crop of flowers is being produced at all elevations in the vicinity of the Fremont Field Station.

Weather:

This report would hardly be complete without a statement of the weather situation during the past month. In the recorded history of the Central Rocky Mountain territory, it is probable that at no other time has such a sudden change from one climatic extreme to another been experienced as has been the case this spring. Four years of extreme drouth were terminated with a record-breaking fall of precipitation in May. A total precipitation of 8.93 inches was recorded at the Fremont Station, this exceeding by 9 per cent the previous maximum recorded during June, 1921, the month of the disastrous Pueblo flood. It is curious to note, that in the town of Manitou at the base of the mountains below the Fremont Station, the total fall was even greater, being approximately 9 1/2 inches.

The average air temperature at Fremont during May was 5 degrees below normal, while the mean maximum temperature was 0.4° F. below that of April. Soil temperatures at a depth of 4 feet also dropped precipitously, the average for May, 40.94°F., being 1.33°F. lower than the April average and only 2.58° F. higher than the average for the coldest month (February) of the preceding winter. On May 25, almost at the beginning of the growing season, a reading of only 39.0° F. was obtained, which was but 1.4° F. above the minimum recorded for the winter.

The prevailing low air and soil temperatures and the heavy precipitation, which, with the exception of two days, was well spread out over 24 days, were accompanied by a minimum of sunshine (there was one clear day during the month at Fremont), the total for the month being far below the previously recorded minimum for any one month at that Station. This favorable combination of weather conditions, taken in connection with the almost bone-dry condition of the soil everywhere along the Eastern Slope, insured a minimum amount of surface runoff, and a maximum expectation of water available for storage.

The disastrous floods which have been sweeping across the foot-hills territory and plains states since the first of June are not the result of heavy or excessive runoff in the mountains, rather their origin rests in a large number of distinctly local storms that have delivered rain in cloudburst-like proportions in the territory along the eastern base of the mountains. An instance of the local character of these storms is furnished by the situation in the Pikes Peak Region on Memorial Day when the worst flood

in its history struck Colorado Springs. While the foothills area immediately north of the city, and within the city itself, was deluged by a series of extremely heavy rains that lifted the streams draining the overgrazed, thinly vegetated, heavy-soiled slopes far above their banks, only a trace of precipitation fell at the Fremont Station less than 10 miles away. The extreme peculiarity of the weather that has prevailed this spring was further emphasized locally when a dust storm blew in from the southeast on the heels of the rain and filled the local atmosphere with dust while the flood was at its height.

So far as these dust storms are concerned, the problem of their solution is not to be found in the return of an era of normal precipitation. Not until the native grasses, or a substitute cover of vegetation, is established on the mismanagement lands of the "dust-bowl" will it be possible to secure abatement of this "new-fangled", pernicious climatic phenomenon.

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